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Maternal factors associated with low birth weight in governmental hospitals of Wollo District, Northeast Ethiopia: a cross sectional study

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Abstract

Introduction: *low birth weight is a public health problem worldwide affecting around 16% of births and the major cause of neonatal deaths and growth failure. Its implication is to identify causes, prevent trans generational link of nutrition-related problems and promoting the health of future generations. The objective of this study was to assess magnitude of low birth weight and identify maternal factors associated with it among newborns delivered in governmental hospitals.* ***Methods:*** *design: institutional based cross-sectional study design. Setting: maternity ward of wollo district governmental hospitals, Ethiopia. Subjects: six hundred sixty mothers who gave birth between from April 2018 to June 2018 were identified. Main outcome measures: normal and low birth weight.* ***Results:*** *the prevalence of low birth weight was 17.4%. Sex of the infants (AOR: 3.35, 95%CI: 1.76, 6.38), birth interval of less than 24 months (AOR: 3.21, 95%CI: 1.35, 7.82), previous history of giving LBW baby (AOR: 3.11,95% CI: 1.43, 6.82), maternal MUAC of less than 23 cm (AOR: 2.22, 95%CI: 1.17,4.23), maternal height less than 150 cm (AOR: 3.01 , 95% CI : 1.39,6.51), maternal hemoglobin less than 12g/dl (AOR: 3,49,95% CI : 1.80,6.77), no ANC visit (AOR=4.07, 95% CI: 1.17,14.11), didn´t get nutrition education (AOR: 2.67,95% CI: 1.36, 4.25), food insecurity (AOR: 2.71,95%CI: 1.44, 5.08), inadequate dietary diversity (AOR: 2.76, 95%CI: 1.50,5.07), chew chat (AOR=3.59,95% CI: 1.41,9.16) and drink more than three cups of coffee per day (AOR=3.75,95% CI: 1.47,9.62) were found to be associated with low birth weight.* ***Conclusion:*** *attention to early maternal nutritional status assessment with dietary advice and food security status in combating LBW in the area.*

Introduction

Low Birth Weight (LBW) is defined as having a birth weight of less than 2500 gram measured with in 24 hour of birth irrespective of the gestational age of the neonate. It can be further categorized in to three, low birth weight is defined as less than 2500 grams, very low birth weight is less than 1500 gram and extremely low birth weight is less than 1000 gram. It is public health problem worldwide affecting 16% births [1,2]. Being undernourished in the womb increases the risk of death in the early months and years of a child´s life [3,4]. Factors that affect birth weight can be relate to the infant, the mother or the physical environment [3,5]. The world assembly and the Ethiopian national nutritional programme also plan in reduction of low birth weight [6,7]. A normal birth weight at birth, 2500 to 4500 gram, is a strong indicator of infant survival, growth, development and good indicator of health of mother and infant [8].

However, LBW is one of major public health problem worldwide. Globally, World Health Organization estimates in 2013, nearly 22 million (16 percent) of all new borns are LBW. Nearly 90% of them are in the developing world but the prevalence estimate greatly varies across regions and even within country. The higher prevalence is in South Asia (28%) and sub-Saharan Africa (13%) [9]. In Ethiopia LBW estimate risen from 2000 to 2005 from 15.0% to 20.3% with 1.1% increase per year and the current profile is 11% in 2011 and 13% in 2016 [10,11]. Inspite of this high prevalence, accurate monitoring is challenging since nearly half of the world´s infants are not weighed at birth which is very high in sub-Saharan Africa and also in Ethiopia where 54% and 95% of the infants are not weighted after birth, respectively. This issue is likely to underestimate the true magnitude of the problem [9,11].

In 2012, one of the World Health Assembly plan for 2025 was 30% reduction of the number of infants born with a weight lower than 2500 g, with 3.9% relative reduction per year between 2012 and 2025 [6]. In Ethiopia also sustainable development goal (SDG) 3 states ensuring healthy lives and promote well-being for all at all age. The achievement of this goal is strongly influenced by progress in reduction of LBW since it is one of the leading cause of neonatal mortality. There is little information about the effect of nutrition related

factors on low birth weight. Therefore, the aim of this study is assessing the major ignored and easily modifiable maternal nutrition related causes of low birth weight like maternal nutritional status and dietary habits as primarily to prevent it´s immediate and long term consequences, trans generational link of nutrition-related problems and promoting the health of future generations. It is important for the achievement of sustainable development goal and the Seqota Declaration. Therefore, the study was aimed to assess magnitude of Low Birth Weight and identify maternal factors associated with it among newborns delivered in governmental hospitals, North East Ethiopia, 2018.

Methods

Study design and period: institutional based cross sectional study was conducted from April 25th 2018 to June 1st 2018 in Wollo District, Northeast Ethiopia, Amhara regional state which is located 350 km from the capital city Addis Ababa. The district is divided into two zones, South Wollo Zone and North Wollo Zone. There are 11 governmental hospitals 35 health centres and 92 health posts in the two Zones [12,13].

Source population: all mothers with newborns delivered in governmental hospitals in Wollo District, North East Ethiopia.

Study population: all mother newborn pairs in selected governmental hospitals of Wollo District, North east Ethiopia.

Inclusion and exclusion criteria: all randomly selected newborn babies with their mothers who gave live birth in the hospitals were included and New-born babies whose mothers were critically ill and twin delivery excluded.

Sample size determination: sample size was determined by using Single population proportion formula by taking 14.6% from similar recent research performed in Tigray, Northern 0 By using the 95% CI and 4% marginal error (d) which gave sample size of 300. Considering 2% of the design effect for multistage sampling technique and nonresponse rate of 10% the final sample size becomes 660.

Sampling technique: the sample size was proportionally allocated to each hospital in the study area and systematic sampling (k=2) was used to enroll study participants.

Sampling procedure: during the first stage, hospitals were stratified based on their location. The 6 governmental hospitals (2 zonal and 4 district) were randomly selected from the total of 11 (3 zonal and 8 district hospitals) randomly. Then, the calculated sample size (660) was proportionally allocated to these hospitals based on the delivery case load registration. Finally the data were collected in every other newborn mother pairs by using systematic sampling technique and the starting pair was selected by simple random sampling method. By considering the 1267 live births registered on the six health facilities obtained from delivery registration during the past year (April, 2017).

Data collection tools and procedures: structured interviewer administered questionnaire was used to collect data. The questionnaire was developed in English and translated to Amharic language and then back to English to check for its consistency. Questionnaires contained maternal socio-demographic, health care service utilization, maternity nutrition and anthropometric assessment.

Data quality assurance: to ensure quality data, training was given to data collectors and supervisor. Questionnaires were examined for completeness and consistency during data collection. Data were collected through interviewing the mother and measuring the weight of the newborn. Data were collected from mothers in the health facility became stable after delivery. The tools were validated and frequent calibrating done appropriately. The maternal charts and referral papers were also revised for necessary

information´s like ante-natal clinic (ANC) attendance, early ultrasound and maternal health conditions. There were supervisors that provide assistance during data collection. Pretesting was conducted in 5% of the sample size in Boru Hospital before the actual data collection. Additionally, data was carefully cleaned and cautiously entered for the commencement of analysis.

Data processing and analysis: data were entered into Epi Data 3.1 then exported to SPSS version 20 software for analysis. First, descriptive statistics was done to determine the magnitude of low birth weight. Both bivariate and multivariable logistic regression analysis were performed to assess association low birth weight and the independent variables. Variables which had significant association were identified on the basis of adjusted odds ratio (AOR), with 95%CI and with P-value ≤0.05. In addition the fitness of the model was checked using the Hosmer and Lemeshow goodness of fit-test with P-value 0.507.

Ethical consideration: letter of ethical approval was received from University of Gondar Institutional Research Ethics Review Committee. Official letter of cooperation was also obtained from Wollo District health offices and written consent was taken from each hospital managers. The mothers were well informed about the aim of the study and procedure. Additionally, it was explained that they have a full right not to be involved in the study and their agreement was ascertained by their verbal consent. The respondents´ confidentiality of information was assured by excluding names and identifiers from the questionnaire.

Results

Socio-demographic characteristics of study participants: a total of 627 mothers with their newborns were included in the final analysis which made a response rate of 95%. Among this majority of the mothers, 523 (83.4%) were aged between 20-34 years, almost all of the respondents were married 585 (93.3%) and nearly half, 299(47.8%), were orthodox. Regarding educational status of parents, one hundred and thirty-one (20.9%) of the mothers were unable to read and write. However, more than a quarter (28.4%) of the fathers attended college and above. More than one fourth of the mothers, (26.6%), were housewives. It was also found that more than three fourth (77.5%) of the respondents were residing in urban areas. Less than five family size was seen among 428 (68.3%) respondents and more than half (57%) of the mothers had at least one under five children in the family (Table 1).

Nutritional status and feeding practice of mothers: height, mid-upper arm circumference (MUAC) and hemoglobin level were taken from mothers and found that 83 (13.2%) of mothers have height less than 150 cm and 196 (31.3%) have MUAC less than 23 cm. Hemoglobin level of less than 12mg/dl was seen among 137 (21.9%) respondents before delivery. Only one third, (32.2%), of the mothers consumed more than three meals per day and more than half, (58.7%) had irregular feeding habit. The mean dietary diversity score was 5.96 (SD±1.146) which ranged from 2-10 food groups. More than one third (35.1%) of mothers had poor dietary diversity score. It was also found that 238 (38%) of the mothers lived in food insecure households (Table 2).

Maternal health service utilization, obstetric history and new born related characteristics: about 557 (88.8%) of the respondents had ANC follow up during their last pregnancy and of which one fourth 149 (26.8%) had four and abovevisits. Three hundred and sixty-one (64.8%) of the mothers started ANC visit in their second trimester of pregnancy. More than one third (34.9%) of the mothers did not supplemented with iron folic acid tablet. Only 100 (15.9%) of the mothers took anthelmintic during their last pregnancy. Five hundred and eleven (81.5%) mothers were multiparous. From this 103 (20.2%) had birth space less than 24 months and 57 (11.2%) had history of small baby in their previous birth. Out of the total respondents 30 (4.8%) had history of APH, while 46 (7.3%) and 81 (12.9%) had history of pregnancy

induced hypertension and hyperemesis gravida respectively. When we see the newborn status more than half of the newborns (55.3%) were females and 32 (5.1%) of newborns are premature (Table 3).

Maternal behavior and medical health condition: chat chewing and alcohol drinking were reported by 55 (8.8%) and 37 (5.9%) of the respondents, respectively during the recent pregnancy. Two hundred and forty-nine (39.7%) mothers drunk more than three cups of coffee per day and 127 (20.3%) took herbal medications. Of the total 26 (4.1%) and 47 (7.5%) mothers had HIV and hypertension, respectively (Table 4).

Prevalence of Low birth weight among newborns: in this study, the prevalence of LBW was 17.4%. The mean (±SD) birth weight of the new born was 2871 (±568) gram. The prevalence of low birth weight is 20.1% in female newborns and 14% in male newborns. Mothers with less hemoglobin level has high prevalence of giving birth to low birth weight newborns than normal hemoglobin level mothers (63.5% and 12% respectively) and the prevalence is 40.9% in short stature mothers and 27.2% in mothers who have inadequate dietary diversity score.

Factors associated with low birth weight among newborns: in multivariable logistic regression analysis previous history of giving small baby, sex of new born, khat chewing, drinking coffee, maternal hemoglobin, DDS, food security, birth interval, ANC follow up, nutrition education during ANC, maternal height and MUAC were significantly associated with low birth weight. Being female has three fold risk for low birth weight (AOR: 3.35, 95%CI: 1.76, 6.38). Birth interval of less than 24 month triples the risk of low birth weight than birth interval of more than five years (AOR: 3.21, 95%CI: 1.35,7.82). Mothers who had previous history of giving LBW baby are 3 times more likely to deliver low birth weight baby compared to their counter parts (AOR: 3.11, 95% CI: 1.43,6.82). The odds of LBW delivery were 2.2 times higher for mothers with mid upper arm circumference of less than 23 cm compared to mothers with MUAC level of greater than or equal to 23 cm (AOR: 2.22, 95%CI: 1.17, 4.23) and also the odds of LBW delivery were 3 times higher in mothers whose height is less than 150cm compared to taller ones (AOR: 3.01, 95% CI: 1.39, 6.51). Moreover mothers whose hemoglobin level was less than 12g/dl had 3.5 times more likely to deliver low birth weight baby (AOR: 3,49, 95% CI: 1.80,6.77) than mothers with hemoglobin level greater than or equals to 12g/dl. Mothers who had no ANC visit during the current pregnancy were four times (AOR=4.07, 95% CI: 1.17, 14.11) and mothers with less than 4 visits were 3.5 times (AOR=3.51, 95% CI: 1.26, 9.77) more likely to give birth to LBW baby than mothers who had greater than four visits, respectively. Similarly mothers who didn´t get nutritional counselling were 2.7 times more likely to had low birth weight neonate (AOR: 2.67, 95% CI: 1.36,4.25) than their counterparts. The odds of LBW were 2.7 times higher in food in secured mothers compared to food secured ones (AOR: 2.71, 95%CI: 1.44,5.08) and also mothers with inadequate dietary diversity were 2.8 times more likely to deliver low birth weight baby compared to mothers with adequate dietary diversity (AOR: 2.76, 95%CI: 1.50,5.07). Mothers who chew khat were 3.6 times (AOR=3.59, 95% CI: 1.41, 9.16) and mothers who drink more than three cups of coffee per day were 3.7 times (AOR=3.75, 95% CI: 1.47, 9.62) more likely to give birth to LBW baby than mothers who did not chew khat and drink coffee during the current pregnancy, respectively (Table 5).

Discussion

Birth weight is one of the most important biologic predictors of infant survival, growth, development and good indicator of health of mother and infant [2]. In this study, the prevalence of low birth weight was 17.4% which was consistent with studies conducted in Zimbabwe (16.7%) and Gondar (17.4%) [15,16]. However, the result is relatively higher when compared to other institutional based studies in Addis Ababa (8.8%) and Tigray (14.6%) [14,15]. The possible

explanation between the variations might be the difference in geographical and seasonal variations and the health service utilization and maternal nutritional status like maternal anemia and MUAC was relatively better in this study areas. The study finding was also higher than 2016 Ethiopian demographic health survey (EDHS) report which is 13% [11]. The possible explanation for the variation might be the draw backs of EDHS like using secondary data and more than half of newborns in Ethiopia are not weighted at birth. On the other hand, the present finding was lower as compared to studies done in India (40%), Nepal (21.5) and Kersa (28.3%) [16-18]. The possible reason might be the geographical variations and the above studies were carried out in peripheral health facilities where many of the pregnant women might be in high risk pregnancy and also there might be variation in characteristics of study population like nutritional status and food insecurity which can affect the new born weight.

In this study, mothers with hemoglobin level less than 12g/dl were 3.5 times more likely to deliver LBW neonate than mothers with normal hemoglobin level. This finding is in line with a studies done in Nepal, Adwa and Ghana [16,19,20], which might be because of insufficient oxygen supply to the fetus for normal growth and development in low maternal hemoglobin state [4,21]. The other predictor variable of LBW in this study was maternal MUAC less than 23 cm in which doubles the risk of giving birth to LBW babies. It was also found in other studies like study done in Zimbabwe and Diredawa [22,23]. The possible explanation for this might be maternal nutritional status during pregnancy can affect maternal nutrient store and there is a nutrient competition b/n the fetus and the mother that can affect the fetal nutrient supply which is vital for fetal growth and development [4]. The odds of LBW delivery was 3 times higher in mothers whose height is less than 150 cm compared to taller ones, which is in line with study conducted in India [24]. This finding can be one explanatory of the intergenerational nature of growth failure which is in this study maternal nutritional status like low MUAC and anemia are more prevalent in stunted women [4]. Being female was associated with low birth weight. This finding is in line with a study done Kenya, Tigray and Gondar [14,25,26].

Mothers with ANC follow up has less risk of giving LBW babies. Which is in line with study conducted in Nepal and Tigray [16,19]. This may be attributed to the beneficial impact of ANC on pregnancy outcome, either through the testing and treatment of complications or by contributing to the reduction of modifiable maternal risk factors by providing an array of available medical, nutritional and educational interventions. Moreover, mothers who did not get nutritional education during their time of pregnancy were 2.7 times more likely to delivered LBW neonate. It has also same result in other study [26]. This might be due to that those who got nutritional counseling might change their feeding behavior and their nutritional status might change too that might help them to decrease the risk of delivering LBW baby. This study shows that women who had previous history of giving birth to LBW babies triple the risk of giving LBW babies compared to women´s gave normal birth weight babies previously. This finding is supported with a study in Kenya [25]. This can be due to the majority of risk factors for LBW are likely to persist into future pregnancies and these women could potentially be at higher risk of a repeat birth of a LBW baby [27]. Drinking more than three cups of coffee per day also increased the risk of low birth weight in the newborn which is in line with other studies [28,29]. The reason might be as the half-life of caffeine increase in pregnant women it can pass placenta easily and can cause vasoconstriction and hypoxia in the fetus. In the present study there was significant association between maternal DDS and infant weight at birth. Mothers with inadequate dietary diversity were 2.8 times more likely to deliver low birth weight babies compared to mothers with adequate dietary diversity. This has same result with the study in Ghana [20]. The reason behind this can be the major influence

regulating fetal growth is the supply of nutrients from the mother to the fetus so mothers with good diet can get adequate energy and nutrients that can supply the fetus for better growth and development [8].

In this study birth interval less than 24 month triple the risk of low birth weight. This finding is supported by other studies conducted in Nepal and Bale, Ethiopia [18,30]. The reason could be due to the fact that short inter-pregnancy interval might result in inadequate replacement of maternal nutrient stores depleted in the previous pregnancy. Khat chewing also increase the risk of low birth weight as supported by other studies in Bale and Yemen [30,31]. This can be due to chat can affect maternal nutritional status by decrease appetite and nutrient absorption and can increase the risk of parasitic infection and also can affect fetal metabolism and development by cause high blood pressure and placental insufficiency. Finally, the odds of LBW delivery was 2.7 times higher in food insecure mothers compared to food secured ones. A study conducted in Mexico shows that women in the lower socio-economic level had a higher risk for LBW than those in the medium and high socioeconomic levels [32]. This can be due to women from food insecure households are at risk offer both macro- and micro-nutrient deficiencies, poor accessibility of adequate and diverse diet that can affect maternal nutritional status and also fetal nutrient supply. The other reason might be food insecurity leads to poor maternal mental health (depressive symptoms and anxiety, loss of appetite) and health behaviors (nutrition) [33].

Conclusion

The prevalence of low birth weight in this study was high. Being female newborn, number of ANC visit, absence of nutritional education at ANC, previous history of giving LBW baby, chat chewing, drinking greater than three cups of coffee per day, maternal mid upper arm circumstance of below 23 cm, maternal height less than 150 cm, hemoglobin level <12gm/dl, birth interval less than 24 months, inadequate maternal dietary diversity score and food insecurity were predictors of low birth weight.

Strength and limitation: the strength of this study is mostly focus on previously less assessed nutrition related causes of low birth weight and taking new born weight up to one hour of delivery and the limitation is Maternal weight change during pregnancy not accessed in this study because most of the mothers start ANC follows up in the second trimester of their pregnancy.

What is known about this topic

- *In Ethiopia the low birth weight estimate is rising every year;*
- *Low birth weight is the leading cause of neonatal mortality for those who survives it reduces growth and development like stunting as an adult they have high risk of chronic disease and the intergenerational effect of malnutrition will continue;*
- *Despite the fact intrauterine growth and development the most critical period in human life cycle, modifiable maternal nutrition related causes of low birth weight (maternal nutritional status, dietary diversity score, house hold food security stats) not well studied as compared to the gynaecological and obstetric factors of low birth weight.*

What this study adds

- *The prevalence of low birth weight in Wollo is high and above the national level;*
- *Around 38% of the mothers live in food in secured households and are more likely to give birth to low birth weight infants which shows the intergenerational link of malnutrition so immediate and wide safety net program is needed in Wollo district;*

- *Programmes/strategies related to neonatal health and low birth weight should address not only gynaecological and obstetric factors but also maternal nutrition related factors that affect intrauterine growth and development.*

Competing interests

The authors declare no competing interests.

Authors' contributions

GAL, MKM, ZAA and AA came up with the research idea, analyzed the results and write the manuscript. They agreed to take the accountability regarding all aspects of the work. All authors read and approved the final manuscript.

Tables

Table 1: socio-demographic characteristics of study participants in Wollo District, Northeast Ethiopia, May, 2018

Table 2: nutritional status and feeding practice of mothers in Wollo District, North east Ethiopia, May, 2018

Table 3: maternal health service utilization, obstetric history and new born related characteristics in Wollo district, Northeast Ethiopia, May, 2018

Table 4: maternal behavior and other medical conditions in Wollo District, North east Ethiopia, May, 2018

Table 5: bivariate and multivariable logistic regression model predicting the likelihood of low birth weight among newborns delivered in governmental hospitals of Wollo District, Northeast Ethiopia, May, 2018

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Table 1: socio-demographic characteristics of study participants in Wollo District, Northeast Ethiopia, May, 2018

Variable	Characteristics	Frequency	Percentage
Age of mother	<20	17	2.7
	20-34	523	83.4
	35 and above	87	13.9
Religion	Orthodox	299	47.8
	Muslim	200	31.9
	Protestant	57	9.1
	Others	20	3.2
Marital status	Married	585	93.3
	Single	13	2.1
	Divorced	13	2.1
	Separated	16	2.6
Educational status of mother	Unable to read and write	131	20.9
	Read and write	79	12.6
	Elementary	183	29.2
	Secondary	126	20.1
	College and above	108	17.2
Educational status of father	Unable to read and write	107	17.1
	Read and write	73	11.6
	Elementary	121	19.3
	Secondary	148	23.6
	College and above	178	28.4
Occupational status of mother	House wife	167	26.6
	Government employe	147	23.4
	Private worker	125	19.9
	Farmer	113	18.0
	Daily labourer	75	12.0
Residence	Urban	486	77.5
	Rural	141	22.5
Family size	Less than five	428	68.3
	Five and above	199	31.7
Under 5 children	No	270	43.1
	1	288	45.9
	2	69	11.0

Table 2: nutritional status and feeding practice of mothers in Wollo District, North east Ethiopia, May, 2018			
Variables	**Characteristics**	**Frequency**	**Percentage**
Meal frequency	<=3meals /day	425	67.8
	>3meals/day	202	32.2
Meal pattern	Regular	259	41.3
	Irregular	368	58.7
MUAC	<23 cm	196	31.3
	>=23 cm	431	68.7
Height	<150 cm	83	13.2
	>=150 cm	544	86.8
Haemoglobin	<12 (g/dl)	137	21.9
	>=12 (g/dl)	490	78.1
Dietary diversity score	Inadequate	220	35.1
	Adequate	407	64.9
Food security	In secured	238	38.0
	Secured	389	62.0

Table 3: maternal health service utilization, obstetric history and new born related characteristics in Wollo district, Northeast Ethiopia, May, 2018

Variable		Characteristics	Frequency	Percentage
ANC follow up		No	70	11.2
		Yes	557	88.8
Number of ANC visits		<4 visit	408	73.2
		>=4 visit	149	26.8
Time of initiation		1st trimester	182	32.7
		2nd trimester	361	64.8
		3rd trimester	14	2.5
IFA tablets		No tablet	219	34.9
		<60 tablets	176	28.1
		60-90 tablets	196	31.3
		>=90 tablets	36	5.7
Take Antihelmentic (deworming)		No	527	84.1
		Yes	100	15.9
Nutrition education		Yes	358	57
		No	269	43
Sex of new born		Female	347	55.3
		Male	280	44.7
Gestational age		<37 weeks	32	5.1
		>=37 weeks	595	94.9
Parity		1	116	18.5
		2-3	448	71.5
		>=4	63	10.0
Birth interval		<24 months	103	20.2
		24-59 months	254	49.7
		60 and above	154	30.1
Previous history of LBW delivery		Yes	57	11.2
		No	454	88.8
Pregnancy related health conditions	STI	Yes	10	1.6
		No	617	98.4
	APH	Yes	30	4.8
		No	597	95.2
	Gestational DM	Yes	7	1.1
		No	620	98.9
	Pregnancy induced Hypertension	Yes	46	7.3
		No	581	92.7
	Hypermisis Gravidarem	Yes	81	12.9
		No	546	87.1

Table 4: maternal behaviour and other medical conditions in Wollo District, North east Ethiopia, May, 2018

Variables		Characteristics	Frequency	Percentage
Chat		Yes	55	8.8
		No	572	91.2
Alcohol		Yes	37	5.9
		No	590	94.1
Smoking		Yes	13	2.1
		No	614	97.9
Coffee		No	152	24.2
		<=3cups per day	226	36.0
		>3 cups per day	249	39.7
Herbal medication		Yes	127	20.3
		No	500	79.7
Medical conditions	HIV /AIDS	Yes	26	4.1
		No	601	95.9
	Tuberculosis	Yes	5	0.8
		No	622	99.2
	Malaria	Yes	6	1.0
		No	621	99.0
	Diabetics mellitus	Yes	11	1.8
		No	616	98.2
	hypertension	Yes	47	7.5
		No	580	92.5

Table 5: bivariate and multivariable logistic regression model predicting the likelihood of low birth weight among new-borns delivered in governmental hospitals of Wollo District ,Northeast Ethiopia, May 2018

Variables	**Characteristics**	**Low birth weight**		**Odds ratio**	
Previous History		Low birth weight	Normal	COR (95%CI)	AOR (95%CI)
	Yes	18	39	2.92(1.57,5.42)	3.12(1.43,6.82)**
	No	62	392	1	1
Sex of new born	Female	70	277	1.56(1.02,2.39)	3.35(1.76,6.38)**
	Male	39	241	1	1
Chewing khat during pregnancy	Yes	16	39	2.11(1.13,3.94)	3.59(1.41,9.16)*
	No	93	479	1	1
Drinking coffee during pregnancy	>3 cups per day	56	193	2.47(1.36,4.48)	3.76(1.47,9.62)*
	<=3 cups per day	37	189	1.66(0.89,3.11)	1.21(0.45,3.21)
	No drinking	16	136	1	1
Haemoglobin	Up to 11.9g/dl	50	87	4.19(2.70,6.53)	3.49(1.80,6.77)**
	12g/dl and above	59	431	1	1
DDS	Inadequate DDs	60	160	2.74(1.79,4.17)	2.76(1.50,5.07)**
	Adequate DDS	49	358	1	1
Gestational age (week)	<37 weeks	13	19	3.56(1.69,7.44)	2.12(0.74,6.02)
	>=37 weeks	96	499	1	1
Birth interval	<24 months	27	75	3.08(1.56,6.08)	3.25(1.35,7.82)*
	24 to 59months	37	218	1.45(0.78,2.71)	1.89(0.86,4.19)
	60 and above	16	137	1	1
ANC (visit)	No ANC visit	33	37	7.84(7.31,43.54)	4.07(1.17,14.12)*
	<4 visits	69	341	4.05(1.81,9.02)	3.51(1.26,9.77)*
	>=4 visits	7	140	1	1
Nutrition education	No	6	193	3.88(2.48,6.06)	2.68(1.37,3.25)*
	Yes	33	325	1	1
MUAC	<23 cm	53	143	2.48(1.63,3.78)	2.23(1.17,4.23)*
	>=23 cm	56	375	1	1
Height of mother	<150 cm	34	49	4.34(2.63,7.16)	3.01(1.39,6.52)**
	>=150 cm	75	469	1	1
Food security	In secured	68	170	3.39(2.21,5.21)	2.71(1.44,5.08)**
	Secured	41	348	1	1

(Hosmer Lemeshow was fitted with value of 0.507, *=p<0.05, **=p<0.01) backward LR method was used